

CLAIMS

For the convenience of the Examiner, all claims have been presented whether or not an amendment has been made.

1. **(Currently Amended)** A method of storing data in a database, comprising:
obtaining both a first raw form of a data value to be stored;
generating and a first syntax-normalized form of said data value associated with the first raw data value;
assigning at least one attribute identifier and at least one entry identifier to said data;
storing concurrently in a first table and a second table the at least one entry identifier and both the first syntax-normalized data value form and the first raw form of said data value; and
storing the at least one attribute identifier in an attribute table.
receiving a query associated with an object and with the first syntax-normalized data value, wherein:
the object is associated with a first entry identifier; and
the first syntax-normalized data value is associated with an attribute identifier;
retrieving from the first table a plurality of entry identifiers, wherein each of the plurality of entry identifiers is associated, in the first table, with a parent entry identifier that matches the first entry identifier; and
for each of the retrieved entry identifiers:

identifying in the second table an entry associated with the respective retrieved entry identifier, wherein the entry is associated with the attribute identifier and comprises a respective syntax-normalized data value and a respective raw data value; and

if the respective syntax-normalized data value matches the first syntax-normalized data value, retrieving the respective raw data value.

2. (Currently Amended) A method of storing data in a database, as claimed in claim 1, wherein ~~said obtaining comprises:~~

~~first obtaining a raw form of a data and thereafter generating said first syntax-normalized data value is generated form from said first raw form of the data value.~~

3. (Currently Amended) A method of storing data in a database, as claimed in claim 1, wherein said storing comprises:

maintaining both the first syntax-normalized ~~form~~ data value and the first raw data value ~~form of the data~~ for data base searching and data retrieval.

4. (Currently Amended) A method of storing data in a database, as claimed in claim 3 wherein said maintaining comprises maintaining said first raw data value ~~form~~ and said first syntax-normalized data value ~~form of a data~~ in at least two entry tables.

5. (Currently Amended) A method of storing data in a database, as claimed in claim 4, wherein said maintaining further comprises correlating the storage location of said

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first raw data value ~~form~~ and said first syntax-normalized ~~form~~ data value in said at least two entry tables.

6. **(Withdrawn)** A method of storing data in a database, as claimed in claim 2, wherein said generating step comprises:

applying directory service attribute syntax rules to the raw data.

7. **(Withdrawn)** A method of enabling data to be arranged and/or stored in a database used in a directory service system, the method including the steps of:

- a. applying directory service attribute syntaxes rules to the data, and
- b. creating a normalized form of the data.

8. **(Withdrawn)** A method of enabling data to be arranged and/or stored in a database as claimed in claim 7, further comprising:

c. storing said data and the normalized form of the data concurrently in at least one table.

9. **(Withdrawn)** A method of enabling data to be arranged and/or stored in a database as claimed in clam 8, wherein said at least one table comprises a plurality of columns and a plurality of rows, and said storing step comprises storing said data and said normalized form of the data in related locations.

10. **(Withdrawn)** A method of enabling data to be arranged and/or stored in a database as claimed in claim 9, wherein said locations in a table are related by being in a common row.

11. **(Withdrawn)** A method of enabling data to be arranged and/or stored in a database as claimed in claim 8, wherein said at least one table comprises a HIERARCHY table and an OBJECT table.

12. **(Currently Amended)** A method of locating data in a database, wherein at least one attribute identifier is stored in an attribute table and said data is stored in at least two entry tables in a first raw data value is stored in form a first table and a second table and linked to a concurrently stored first syntax-normalized ~~form of the data~~ value, comprising:

~~locating said raw data by searching on said syntax-normalized form of the data.~~

receiving a query associated with an object and with the first syntax-normalized data value, wherein:

the object is associated with a first entry identifier; and

the first syntax-normalized data value is associated with an attribute identifier;

retrieving from the first table a plurality of entry identifiers, wherein each of the plurality of entry identifiers is associated, in the first table, with a parent entry identifier that matches the first entry identifier; and

for each of the retrieved entry identifiers:

identifying in the second table an entry associated with the respective retrieved entry identifier, wherein the entry is associated with the attribute identifier and comprises a respective syntax-normalized data value and a respective raw data value; and

if the respective syntax-normalized data value matches the first syntax-normalized data value, retrieving the respective raw data value.

13. (Withdrawn) A method of locating data in a database, as claimed in claim 12, wherein said searching is performed using SQL.

14. (Withdrawn) A method of locating data in a database, as claimed in claim 12, wherein said searching is performed on an OBJECT table, comprising a plurality of columns and a plurality of rows.

15. **(Withdrawn)** A method of locating data in a database, as claimed in claim 14, further comprising for a data entry:

specifying an attribute ID (AID), said AID being stored in a first one of said plurality of columns and in a predetermined row;

storing an entry ID (EID), said BID being stored in a second one of said plurality of columns and in said predetermined row;

storing a normalized form of said data entry in a third one of said plurality of claims and in said predetermined row.

16. **(Withdrawn)** A method of formatting a find request for a database having stored therein objects including attributes each having a type and value(s), the method including:

- a. creating a database representation of the type (AID); and
- b. creating a database representation of the value(s) (NORM).

17. **(Withdrawn)** A method as claimed in claim 16, wherein step a. is performed by looking up an ATTRIBUTE table.

18. **(Withdrawn)** A method as claimed in claim 16, wherein step b. is performed by applying syntax normalization.

19. **(Withdrawn)** A method of locating objects stored in a database, the method comprising the step of applying AID and NORM to determine a matching object (BID), wherein the method of claim 16 is used to determine AID and / or NORM

20. **(Withdrawn)** A method of locating objects stored in a database, the method comprising the step of applying AID and NORM to determine a matching object (EID), wherein the method of claim 17 is used to determine AID and / or NORM

21. **(Withdrawn)** A method of locating objects stored in a database, the method comprising the step of applying AID and NORM to determine a matching object (EID), wherein the method of claim 18 is used to determine AID and / or NORM

22. **(Withdrawn)** A method of locating objects stored in a database, the method comprising the step of applying AID and NORM to determine a matching object (EID).

23. **(Withdrawn)** A method as claimed in claim 22 wherein the step of applying is performed using SQL.

24. **(Withdrawn)** A method of retrieving contents of object(s) from a database, the method including the step of:

- a. finding row(s) which match a predetermined EID(s).

25. **(Withdrawn)** A method as claimed in claim 24, further including the step of:

- b. returning from the row(s), EID, AID and a raw form.

26. **(Withdrawn)** A method as claimed in claim 25, further including the step of:
- c. converting the result of step b. into objects containing attribute(s), each attribute having a type and value(s).

27. **(Withdrawn)** A method of providing data as an output from a database, the "output being in response to a directory service/query, the method comprising the steps of:
processing said directory service/query to identify said data in the database; and
providing as the output, a raw form of the data.

28. **(Withdrawn)** A method of providing data as an output from a database, as claimed in claim 27, wherein said processing step is based on other than said raw data.

29. **(Withdrawn)** A method of providing data as an output from a database, as claimed in claim 28, wherein said processing step comprises a comparison of data directly corresponding to said raw data but in normalized form.

30. **(Withdrawn)** In a directory service system, having a database in which data is stored in a first form; and a second form, being a normalized form, a method of transferring data into and out of the database, the method including the steps of:

finding data in the database using a normalized form; and transferring data out of the database using a raw form.

31. (Currently Amended) A database apparatus comprising:

means for obtaining both a first raw ~~form of a data~~ value to be stored;

means for generating and a first syntax-normalized form of said data value
associated with the first raw data value;

~~means for assigning at least one attribute identifier and at least one entry identifier to~~
~~said data; and~~

a storage medium operable to ÷ store concurrently in a first table and a second table
~~the at least one entry identifier and both the first syntax-normalized data value form and the~~
first raw form of said data value; and

~~store in an attribute table the at least one attribute identifier.~~

means for receiving a query associated with an object and with the first syntax-
normalized data value, wherein:

the object is associated with a first entry identifier; and

the first syntax-normalized data value is associated with an attribute
identifier;

means for retrieving from the first table a plurality of entry identifiers, wherein
each of the plurality of entry identifiers is associated, in the first table, with a parent
entry identifier that matches the first entry identifier; and

means for searching data, wherein the search comprises, for each of the retrieved
entry identifiers:

identifying in the second table an entry associated with the respective
retrieved entry identifier, wherein the entry is associated with the attribute

identifier and comprises a respective syntax-normalized data value and a respective raw data value; and

if the respective syntax-normalized data value matches the first syntax-normalized data value, retrieving the respective raw data value.

32. (Currently Amended) A database apparatus for storing data in a database, as claimed in claim 31, wherein the first syntax-normalized data value is generated from the first raw data value. said means for obtaining comprises:

~~means for first obtaining a raw form of a data and thereafter generating said syntax-normalized form from said raw form of the data.~~

33. (Currently Amended) A database apparatus for storing data in a database, as claimed in claim 31, wherein said storage medium is operative to maintain both the first syntax-normalized data value ~~form~~ and the first raw ~~form of the data~~ value for data base searching and data retrieval.

34. (Currently Amended) A database apparatus for storing data in a database, as claimed in claim 33, wherein said storage medium is operative to maintain said first raw data value ~~form~~ and said first syntax-normalized ~~form of a data~~ value in at least two entry tables.

35. (Currently Amended) A database apparatus for storing data in a database ; as claimed in claim 34, wherein said storage locations of said first raw data value ~~form~~ and

said **first** syntax-normalized ~~form~~ data value ~~of data~~ are correlated in said at least two entry tables.

36. **(Withdrawn)** A database apparatus for storing data in a database, as claimed in claim 32, further comprising:

means for applying directory service attribute syntax rules to the raw data.

37. **(Withdrawn)** An apparatus for enabling data to be arranged and/or stored in a database used in a directory service system, comprising:

- a. means for applying directory service attribute syntaxes rules to the data;
- b. means for creating a normalized form of the data; and
- c. means for storing said data and the normalized form of the data concurrently in at least one table.

38. **(Withdrawn)** An apparatus for enabling data to be arranged and/or stored in a database as claimed in claim 37, wherein said at least one table comprises a plurality of claims and a plurality of rows, and said storing step comprises storing said data and said normalized form of the data in related locations.

39. **(Withdrawn)** An apparatus for enabling data to be arranged and/or stored in a database as claimed in claim 38, wherein said locations in a table are related by being in common row.

40. **(Withdrawn)** An apparatus for enabling data to be arranged and/or stored in a database as claimed in claim 37 wherein said at least one table comprises a HIERARCHY table and an OBJECT table.

41. **(Currently Amended)** An apparatus for locating data in a database, wherein:
~~at least one attribute identifier is stored in an attribute table and said data is stored in~~
~~at least two entry tables in a~~ a first raw data value is stored in a first table and a second
table form and linked to a concurrently stored first syntax-normalized ~~form of the data~~
value, the first syntax-normalized data value generated from the first raw data value;
and

comprising:

~~means for locating said raw form of the data by searching on said syntax-~~
~~normalized form of the data.~~ receiving a query associated with an object and with
the first syntax-normalized data value, wherein:

the object is associated with a first entry identifier; and

the first syntax-normalized data value is associated with an
attribute identifier;

means for retrieving from the first table a plurality of entry identifiers,
wherein each of the plurality of entry identifiers is associated, in the first table,
with a parent entry identifier that matches the first entry identifier; and

means for searching data, wherein the search comprises, for each of the
retrieved entry identifiers:

identifying in the second table an entry associated with the
respective retrieved entry identifier, wherein the entry is associated with
the attribute identifier and comprises a respective syntax-normalized data
value and a respective raw data value; and
if the respective syntax-normalized data value matches the first
syntax-normalized data value, retrieving the respective raw data value.

42. **(Withdrawn)** An apparatus for locating data in a database, as claimed in claim 41 wherein said searching is performed using SQL.

43. **(Withdrawn)** An apparatus for locating data in a database, as claimed in claim 41, wherein said searching is performed on an OBJECT table, comprising a plurality of claims and a plurality of rows.

44. **(Withdrawn)** An apparatus for formatting a find request for a database having stored therein objects including attributes each having a type and value(s), the apparatus including:

- a. means for creating a database representation of the type (AID), and
- b. means for creating a database representation of the value(s) (NORM).

45. **(Withdrawn)** An apparatus as claimed in claim 4" wherein said means for creating is operative to create a representation by looking up an ATTRIBUTE table.

46. **(Withdrawn)** An apparatus as claimed in claim 4,5, wherein said means for creating is operative to create the data base representation by a means for applying syntax normalization.

47. **(Withdrawn)** An apparatus as claimed in claim 44 is operative to determine AID and/or NORM.

48. **(Withdrawn)** An apparatus as claimed in claim 45 is operative to determine AID and/or NORM.

49. **(Withdrawn)** An apparatus as claimed in claim 46 is operative to determine AID and/or NORM.

50. **(Withdrawn)** An apparatus as claimed in claims 46, wherein the means for applying uses SQL.

51. **(Withdrawn)** An apparatus for locating objects stored in a database, the apparatus comprising means for applying AID and NORM to determine a matching object (EID).

52. **(Withdrawn)** An apparatus as claimed in claim 51, wherein the means for applying uses SQL.

53. **(Withdrawn)** An apparatus for retrieving contents of object(s) from a database, the apparatus comprising:

- a. means for finding row(s) which match a predetermined BID(s).

54. **(Withdrawn)** An apparatus as claimed in claim 53, further comprising:

- b. means for returning from the row(s), BID, AID and a raw form.

55. **(Withdrawn)** An apparatus as claimed in claim 54, further comprising:

- c. means for converting the output of the means for returning into objects containing attribute(s), each attribute having a type and value(s).

56. (Currently Amended) In a directory service system, having a database in which a first raw form data value and a an associated first syntax-normalized data value ~~form of a data~~ are stored in a first table and a second table ~~and at least one attribute identifier is stored in an attribute table~~, apparatus for transferring data into and out of the database, comprising:

~~means for finding data in the database using a syntax-normalized form; and~~

~~means for transferring data out of the database using a raw form.~~

means receiving a query associated with an object and with the first syntax-normalized data value, wherein:

the object is associated with a first entry identifier; and

the first syntax-normalized data value is associated with an attribute identifier;

means for retrieving from the first table a plurality of entry identifiers, wherein each of the plurality of entry identifiers is associated, in the first table, with a parent entry identifier that matches the first entry identifier; and

means for searching data, wherein the search comprises, for each of the retrieved entry identifiers:

identifying in the second table an entry associated with the respective retrieved entry identifier, wherein the entry is associated with the attribute identifier and comprises a respective syntax-normalized data value and a respective raw data value; and

if the respective syntax-normalized data value matches the first syntax-normalized data value, retrieving the respective raw data value.

57. **(Previously Presented)** A computer program product, including a storage medium for storing a computer program, the computer program being executable to perform a method as claimed in any one of claims 1-5.

58. **(Currently Amended)** A method as claimed in any one of claims 1-5 wherein the first raw ~~form~~ of data value is stored in ASN.1 format.

59. **(Withdrawn)** A directory service system as claimed in anyone of claims 30 and 56 wherein the raw form of data is stored in ASN.1 format.

60. **(Currently Amended)** An apparatus as claimed in anyone of claims 31-35 and 41 wherein said ~~protocol encoded raw data or~~ first raw data value is stored in ASN.1 format.

61. **(Cancelled)**